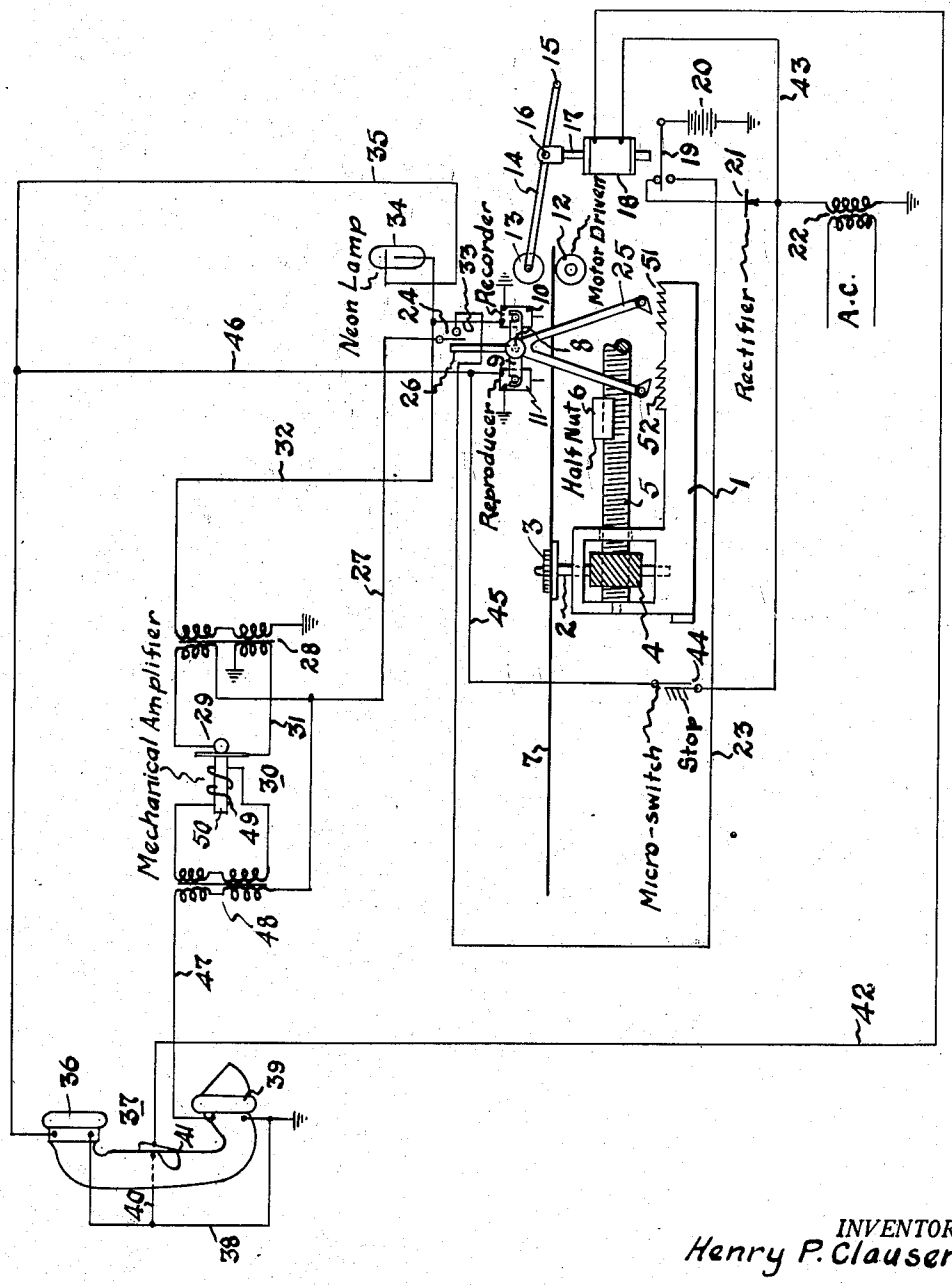
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SOUND RECORDING AND REPRODUCING MACHINE

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SOUND RECORDING AND REPRODUCING MACHINE

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This invention relates to improvements in sound recording and reproducing machines, such as so called dictation machines. The general object of this invention is to provide a greatly simplified mechanism for purposes of sound recording on a permanent record and reproduction therefrom.

In accordance with this general object, a specific object of this invention is to provide a practical machine of this type without the use of multi-stage vacuum tube amplifiers.

In accordance with this object, it is an object of this invention to provide a dictation recording and reproducting machine employing a mechanical amplifier.

Another object of this invention is to provide a simplified form of back spacing and forward spacing mechanism for machines of this type.

Another object of the invention is to provide means for indicating to the dictator that the machine is in operation and ready to receive dictation.

A still further object of the invention is to provide circuit control means whereby, during reproduction, the recording circuits, and particularly the microphone, is disconnected so that no disturbing noises which might enter it can reach the reproducer.

Another object of the invention is to provide a simplified means for preventing further operation of the machine when its record is full.

Additional and more detailed objects of this invention will be apparent from the following detailed description of one embodiment thereof.

This invention resides substantially in the combination, construction, arrangement and relative location of parts, all as will be described in detail below.

In the accompanying drawing, the single figure is a schematic and diagrammatic illustration of one form of the invention.

The mechanism illustrated in the drawing comprises a sound recording and reproducing machine of the type disclosed in full detail in United States Patent No. 2,296,870, issued September 29, 1942, to B. A. Proctor et al. for "Sound recording and reproducing" in which the record comprises a thin flexible disc of suitable material, such as cellulose acetate. In this machine a support is provided for the record which permits it to assume a curved form. This record revolves on its center by reason of its keyed connection to a rotatable spindle which travels radially of the disc as it revolves. The power to operate it is applied directly to the record disc by gripping it between a power driven friction roller and an idler roller. By thus driving the record the spindle supporting it is caused to turn and it in turn drives mechanism which causes the spindle to have a transverse movement in a radial direction.

In accordance with the general object of simplification, the system herein disclosed does not use any form of vacuum tube amplifier. As is well known, amplifiers commonly used for this purpose are multi-stage and involve complex delicate circuits with a multitude of resistors, inductors and capacitors requiring accurate assembly and adjustment. In addition to being relatively bulky, amplifiers of this type require skilled maintenance which is an undesirable feature in many commercial installations.

In accordance with this invention, a mechanical amplifier or, as it is sometimes called, a mechanical repeater is employed for creating the necessary gain in the recording currents supplied by the microphone to the recording head. Mechanical amplifiers or repeaters of this type are old and well known in the electrical arts but it is believed that they have never been incorporated in a sound recording and dictation machine with the resultant simplification thereof. The core of this invention involves a novel combination of such a mechanical amplifier with a dictation recording and reproducing machine to provide a practical, efficient operating assembly. It has been found that with such a mechanism, a gain of from 40 to 50 db. can be secured which is ample for purposes of a machine of this type. In addition, and in accordance with the general object of this invention, further simplifications have been effected to accomplish back spacing and forward spacing and other practical features, as will be apparent from the following description.

Referring now to the illustration in the drawing, the recording and reproducing machine itself is diagrammatically illustrated as including a carriage 1 which is supported for rectilinear motion in any suitable manner, as for example on rods, not shown, as clearly illustrated in said patent. Journalled on the carriage 1 is a vertical spindle 2 which terminates at its upper end in a seat for the recording disc 7, which seat includes some form of member for keying or locking the disc on the spindle. One suitable form of such mechanism is illustrated in the patent mentioned above. At this point, it may be noted that the subject matter of this invention is not limited to use with a flexible record disc but could be used

with a rigid self-supporting recording disc as is now commonly used in the phonograph art. Secured to the spindle 2 is a worm 4 which meshes with a horizontal threaded shaft 5 secured to the carriage 1 but capable of rotation on its axis. The threaded shaft 5 is engaged by a threaded half nut 6 which is fixed so that as the shaft 5 revolves it is caused to move axially in either direction depending upon its direction of rotation and, of course, to move the carriage 1 with it. In a commercial machine, the nut 6 is preferably pivotally mounted so that it can be disconnected from the shaft 5 when the carriage 1 is returned to start a new record.

At 8 is illustrated a rotatable shaft upon which is secured a transversely extending arm 9 having cradles or forked ends in which the recording head 10 and the reproducing head 11 are mounted on trunnions so that they are suspended from the ends of the arm 9 as shown. At 12 is a motor driven friction wheel which engages the under surface of the record disc 7. Positioned above the wheel 12 is an idler wheel 13 adapted to engage the opposite side of the disc 7 in diametrical relation to the wheel 12 so as to grip the disc between them. The idler wheel 13 is rotatably mounted on the end of a lever 14 which in turn is pivotally mounted at 15. Between its ends the lever is pivotally connected at 16 to the plunger 17 of a solenoid 18. The plunger projects below the solenoid so that when it descends it engages the movable contact 19 of a switch which cooperates with a pair of fixed contacts as shown to provide a single pole double throw switch. The contact 19 is connected to one terminal of a suitable current source 20, the other terminal of which is grounded. The uppermost contact of the pair of this switch is connected by a wire to any suitable form of current rectifier 21, such as a copper oxide rectifier. The other terminal of this rectifier is connected to wire 43 and to one terminal of the secondary of a current supply transformer 22, the other terminal of which is grounded. The primary of this transformer is adapted to be connected to a suitable current source, such as the usual A. C. power and lighting circuit. The other terminal of this switch 19 is connected by a wire 23 to the fixed contact of switch 24.

Also secured to the shaft 8 is a pair of levers lying at an angle to each other to provide the forked member 25. At the outer ends of these levers are pivotally mounted pawls, as shown. These pawls cooperate, as will be described later with the sets of ratchet teeth 51 and 52 respectively formed on the carriage 1. Projecting upwardly from the shaft 8 is an arm 26 positioned to operate switch 24 and suitably shaped to provide an operating handle for the shaft 8 and its connected mechanism.

The movable contact of switch 24 is connected by wire 27 to the primaries of the repeating input transformer 48 and output transformer 28. The primary of transformer 28 is provided in the form of two coils to one terminal of one of which the wire 27 is connected and the other terminal of which is connected by a wire to one terminal of the microphone 29 forming part of the mechanical amplifier 30. One terminal of the other primary winding is grounded, as shown, and the other terminal is connected by wire 31 to the other terminal of the microphone 29. The secondary of transformer 28 has one terminal grounded and the other terminal connected by wire 32 to one electrode of the neon lamp 34 and by wire 33 to one terminal of the recording head 10, the other terminal of which is grounded. This recording head may take any suitable form in accordance with well known practice in the art. For example, it may be of the electro-magnetic type or the piezo electric crystal type. The other electrode of the lamp 34 is connected by a wire 35 to one terminal of the receiver 36 of the hand set 37. At this point, it may be noted that the neon lamp 34 should preferably have an internal resistance of about fifty thousand ohms. The other terminal of the receiver 36 is connected by wire 38 to the terminal of the microphone 39 which is grounded. Wire 38 is connected by wire 40 to one contact of a press switch 41 forming part of the hand set. The other contact of this switch is connected by wire 42 to one terminal of the solenoid 18. The other terminal of the solenoid is connected to wire 43, previously mentioned, which wire extends to the fixed contact of a switch 44 which may be of the type known as a micro-switch requiring but little movement to operate it. This fixed contact is mounted on a stop or a button, as illustrated in the drawing, so as to prevent further movement of the carriage 1 after the switch 44 is closed. The movable contact of switch 44 is connected by wire 45 to wire 46 which in turn connects wire 35 to one terminal of the reproducing head 11, the other terminal of which is grounded. Here again, the reproducing head may be any one of the well known types in the art as, for example, the electro-magnetic type or the piezo electric crystal type. The secondary of the repeating transformer 48 is connected to the winding 49 of the mechanical amplifier which is in cooperative relation with a permanently magnetized core 50.

Although mechanical amplifiers are well known in the art, it may be well to note that they comprise in the modern design a receiver and a microphone closely coupled. The diaphragm of the receiver comprises one contact of the microphone which is usually of the carbon granule type. It is also to be noted here that plunger 17 is in raised position, as shown, when solenoid 18 is de-energized and moves down when it is energized to cause the idler roller 13 to engage the record disc 7 under pressure. At this time, switch 19, which is normally in the position shown when solenoid 18 is de-energized, is moved downwardly to engage the lower fixed contact. As soon as solenoid 18 is de-energized, lever 14 raises and switch 19 moves back to normal position.

A description of the operation of this system will now begin.

It will be assumed that the record 7, shown in the drawing, is a fresh record and that it has been impaled upon the spindle 2 in engagement with the keying member 3 as shown. The half nut 6 is then raised and the carriage 1 is pushed to the extreme right since recording on this instrument begins near the center of the record and proceeds in a spiral path to the edge thereof. In order to effect recording, the dictator pushes the member 26 to the right causing clockwise rotation of shaft 8 whereupon the lever 9 undergoes similar movement so that the stylus of the recorder 10 engages the record disc 7. It will be understood that the form of mechanism illustrated may not necessarily be the commercial form, as will be clear from the above mentioned patent, wherein the parts are arranged so that the styli of the recorder and the reproducer may alternately be engaged with the record at ap-

proximately the same radial distance from the center. In order to start dictation, the dictator picks up the hand set 37 and presses switch 41 closed. The closing of switch 41 completes a circuit from the ground through wire 38, wire 40, switch 41, wire 42, solenoid 18, wire 43 to the secondary of transformer 22 and back to ground. This energizes solenoid 18 which pulls lever 14 down to cause the idler roller 13 to engage the record 7. It will be assumed that the motor driven pulley 12 is at this time in rotation. There are many ways in which the circuit for the driving motor, not shown, can be completed so that this will be true. The downward movement of plunger 17 also moves the blade of switch 19 into engagement with the lower contact so that a circuit is completed from the grounded battery source 20 through switch 19, wire 23, switch 24, which closed when the recording head 10 moved into engagement with the record 7, by wire 27 to the connected primaries of each of the transformers 48 and 28. The circuit for the primaries of transformer 48 is completed to ground through the wire 47 and the microphone 39 and the circuit for the primaries of transformer 28 is completed through the microphone 29, wire 31 and connected primary to ground.

The gripping of the record 7 between the wheels 12 and 13 causes it to revolve at a predetermined rate of speed. Here it may be noted that in an actual machine the axes of rotation of the rollers 12 and 13 will be at right angles to those shown in the figure as is clear from the above mentioned patent. They are shown in the drawing out of normal position to facilitate illustration. As the disc 7 rotates, spindle 2 and worm 4 will rotate with it causing the shaft 5 to revolve. At this time nut 6 engages the threaded shaft 5 so that the carriage 1 moves slowly to the left as the record revolves so that the stylus of the recording head 10 will trace a spiral path of gradually increasing radius, the increase amounting, for example, to about five thousandths of an inch per revolution.

In order to record the dictator speaks into the microphone 39, the circuit is completed through the battery 20, as previously described, so that the varying sound pressure waves will cause the microphone 39 to change the resistance in this circuit in accordance with the sounds impressed thereon with the result that currents corresponding to these sounds will be induced in the secondary of transformer 48 and applied to the winding 49 of the receiver portion of the mechanical amplifier 30. The receiver diaphragm will in turn be vibrated in a similar way to affect the resistance in the primary circuit of transformer 28 through the movements of the microphone 29. Battery 20 is also in this circuit so that voice currents suitably amplified will be introduced into the secondary of transformer 28 which is included in a circuit extending from ground through the secondary, wire 32, wire 33, recording head 10 and ground. Thus the stylus of the recording head 10 will be vibrated to impress upon the record 7 a record which is a physical reproduction of the sound waves striking the microphone 39. The currents flowing through the wire 32 will also pass into the neon lamp 34, wire 35, receiver 36 and wire 38 to ground so that neon lamp 34 will flash as the dictator speaks signalling to him both visibly and audibly that the apparatus is in proper working condition. It is, of course, apparent that the visible signal can be observed by watching the lamp 34 and the audible signal will be heard in the receiver 36. The neon lamp 34 will not be lighted all the time but will flash during periods of sound intensity high enough to cause especially high current to flow in the circuit 32—35. At this point it may be noted that there are equivalent devices which could be used in place of the lamp 34, such as a dry rectifier of the selenium or copper oxide type.

The dictator may continue to record until the end of the record, at which time the carriage 1 will engage the micro-switch 44 and close it completing a circuit from the secondary of transformer 22 through switch 44, wire 45, wire 46 to ground through the receiver 36 and wire 38. The alternating current in the secondary of the transformer will impose a characteristic tone current in this circuit apprising the dictator that the end of the record has been reached. In the meantime the movement of the carriage will have been halted by the stop upon which the switch 44 is mounted. Should the dictator continue to hold the switch 41 closed, the driving roller 12 will merely slip on the record 7. Normally, however, when the dictator hears the characteristic tone in the receiver 36, he relieves pressure on switch 41 which opens breaking the circuit to solenoid 18 so that its plunger 17 rises and moves the wheel 13 out of engagement with the record 7 so that the recording machine stops. Switch 19 also moves against a separate contact connecting the battery 20 through the rectifier 21 so that during all off periods this battery will be recharged. The dictator then moves the shaft 8 back to neutral position, as shown in the drawing. He may then remove the record 7 and replace it with a fresh one after which the above described operations may be completed.

Continuing this description of simple recording and reproduction, let it be assumed that a fully recorded record 7 is placed on the machine. The half nut 6 is disengaged and the carriage 1 is moved to the right so that reproduction can be started from the centermost convolutions of the record. The operator 26 is then swung to the left causing counterclockwise rotation of shaft 8 and the engagement of the stylus of reproducer 11 with the record 7. The dictator or transcriber may then press switch 41 again starting the machine in operation, as previously described, so that the record will be reproduced by the pick up 11 and the currents generated thereby transmitted through wire 46 to the receiver 36. It will be noted, at this time, that switch 24 is open so that the circuit from the battery 20 to the primaries of the transformers 48 and 28 remains open. This is desirable so that no extraneous noises entering the microphone can be amplified and pass back to the receiver 36 to interfere with the reproduction from the record. At this time, of course, the neon lamp 34 is not operating since the listener has the reproduction to tell him that the machine is in good operating condition. During recording or reproduction, release of switch 41 causes the machine to immediately stop, and upon pressing it to again start so that the dictator by this simple operation has full control of the machine.

The above description has been without reference to the back spacing mechanism which will now be described. If during dictation the dictator wishes to listen back to a previous portion of the recorded matter, he swings the operator 26 from recording position to reproducing position and after the stylus of the reproducer 11 engages the record, he can, by additional movement of the

operator 26, cause the pawl on the left hand arm of the fork 25 to engage one of the teeth 52 and move the carriage backward, that is to the right, one step for each such movement of the operator 26. The reproducing head 11 is carried in the cradle in the end of the arm 9 so that after its stylus engages the record 7 further movement of the shaft 8 and hence the arm 9 has no effect on the reproducer since it is cradled on trunnions as shown. Repeated additional increments of back spacing movement can be given to the carriage and the record 7, as will be apparent, until the dictator has reached back into the recorded matter what he thinks is the proper distance. He then starts the machine to reproduce that part of the record. If we assume that the dictator has listened to the part he wishes and the record has not yet moved so that the stylus is at the end of the recorded matter, the dictator may move the operator 26 to the right, disengaging the stylus of the reproducer 11 from the record and engaging the stylus of the recorder 10 with the record and then continuing the movement of the operator he can forward space the machine one step at a time for each additional step of the operator until the stylus of the recorder reaches the end of the matter previously recorded, whereupon recording can go forward again as previously described. At the end of a piece of dictation, the dictator before beginning the next, can forward space the record one or 2 grooved distances to provide a visible indication as well as an audible one during transcription to show the end of one piece of dictation and the beginning of another. It is apparent that by the incorporation in an obvious manner of a suitable detent, it will be possible to apprize the operator of the machine by feel when the operator 26 thas been moved far enough to engage either the reproducer or the recorder with the record so that he will not continue the movement of the operator 26 to the point of causing either back spacing or forward spacing. In other words, simply by feel he can tell when the heads are in accurate position without causing spacing movement when this is desired. Thus, the operator can engage or disengage either the recorder or the reproducer with the record at the same point when desired or at a point any desired number of record grooves either side thereof on the same radius.

From the above description, it will be apparent to those skilled in the art that the subject matter of this invention may be embodied in other physical forms and it is not desired, therefore, that the scope of protection afforded by the claims be limited solely by the disclosure but rather by a correct interpretation thereof in the light of the disclosure and the prior knowledge in the art.

What is claimed is:

1. In a sound recording and reproducing machine, the combination comprising means for supporting and moving a record, a recording head, a reproducing head, a microphone, a receiver, a mechanical amplifier, a circuit including said receiver and reproducing head, a circuit including said microphone, mechanical amplifier and recording head, whereby sounds may be amplified and recorded and reproduced, means for supporting the recording and reproducing heads adjacent the record, back spacing and forward spacing means and a single operator for causing alternative engagement of the reproducing and recording means with the record and forward spacing and back spacing respectively of the record.

2. In the combination of claim 1, volume indicating means connected to said receiver and means controlled by said operator for connecting said signalling means to the amplifier during recording.

3. In a sound recording machine, the combination comprising means for rotatably supporting a record, means for causing rotation of said record, a recording head, a microphone, an electro-mechanical amplifier, a current source, a circuit including said microphone, amplifier and recording head, a circuit including a switch for connecting said current source to said amplifier, and means associated with said microphone for starting and stopping said means for rotating said record and for operating said switch during rotation of said record to complete said current source circuit.

4. In a sound recording machine, the combination comprising means for rotatably supporting a record, means for causing rotation of said record, a recording head, a microphone, a mechanical amplifier, a current source, a circuit including said microphone, amplifier and recording head, a circuit including a switch for connecting said current source to said amplifier, means for starting and stopping said means for rotating said record and for operating said switch during rotation of said record to complete said current source circuit and a rectifier connected by said switch to said current source when said record is standing still and disconnected from said current source when it is connected to said amplifier.

5. In a sound recording machine, the combination including means for supporting and moving a record, a recording head, a microphone, a mechanical amplifier, a circuit including the microphone, amplifier and recording head, whereby sound impressed upon the microphone may be recorded on the record, a receiver, and means connected to said amplifier for indicating when the signal being recorded exceeds a desired volume.

6. In the combination of claim 5, said indicating means comprising a gas discharge device.

7. In a sound recording machine, the combination including means for supporting and moving a record, a recording head, a microphone, a mechanical amplifier, a circuit including the microphone, amplifier and recording head, whereby sound impressed upon the microphone may be recorded on the record, a receiver, and means connected to said amplifier and to said receiver for indicating in said receiver when the signal being recorded exceeds a desired volume.

8. In the combination of claim 7, said indicating means comprising a gas discharge device.

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